Amendments to the Claims: This listing of claims will replace all prior versions, and listings, of claims in the application

Listing of Claims:

1.   (Currently Amended) A repeat field detecting apparatus which is used in a video progressive conversion reproducing apparatus of converting a video input signal of interlace scheme into a video signal of progressive scheme and which detects whether said video input signal is a repeat field where the same video image is outputted repeatedly or an ordinary field which is other than said repeat field, said repeat field detecting apparatus comprising:

a first RF determining means of identifying a repeat field having a predetermined distance from said video input signal, on the basis of a discrepancy pixel number which is the number of the pixels having discrepancy between the pixel information of a field of said video input signal and the pixel information of a field of said video input signal having a predetermined distance from the former-mentioned field of the video input signal;

M/N ratio calculating means of obtaining an N component which is the number of discrepancy pixels between said repeat fields and an M component which is the number of discrepancy pixels between at least a pair of fields which are other than said repeat fields and have said predetermined distance from each other, and then calculating an M/N ratio which is the ratio of said M component to said N component;

RF determination reliability calculating means of outputting the reliability of the determination result of said first RF determining means on the basis of the output of said M/N ratio calculating means; and

M/N ratio adaptive repeat field confirming means of confirming the output of said first RF determining means as the determination result on the basis of said reliability outputted from said RF determination reliability calculating means.

2.   (Currently Amended) A repeat field detecting apparatus according to claim 1, wherein

said predetermined distance is a distance having one field therebetween, and wherein

said at least a pair of fields are ~~pairs of four adjacent fields~~ <u>one or more pairs of fields among four pairs of fields which adjoin the arbitrary pair of fields which measure a M/N ratio</u>.

3.   (Original) A repeat field detecting apparatus according to claim 1, wherein

said at least a pair is two pairs or more, and wherein

said M component is the average between the discrepancy pixel numbers of said two pairs or more of fields.

4.   (Original) A repeat field detecting apparatus according to claim 1, wherein said M/N ratio adaptive repeat field confirming means determines the field as an ordinary field until five fields have elapsed from the initial state, and wherein after five or more fields have elapsed from the initial state, said M/N ratio adaptive repeat field confirming means determines the field as an ordinary field when the output of said RF determination reliability calculating means is smaller than a predetermined threshold value, and sets the output of said first RF determining means as the determination result when the output of said RF determination reliability calculating means is greater than or equal to said predetermined threshold value.

5.   (Original) A repeat field detecting apparatus according to claim 1, wherein said M/N ratio calculating means comprises:

discrepancy pixel history means of storing the history of said discrepancy pixel numbers for the past five fields including the present value at each time when said video input signal advances by one field;

N component detecting means of setting the minimum value among the values stored in said discrepancy pixel history means as an N component indicating the amount of the noise component on the time axis of the input video signal, at each time when said video input signal advances by one field;

M component detecting means of subtracting the value detected by said N component detecting means from the sum of all the five values stored in said discrepancy pixel history means, then dividing the value by four, and then setting this result as an M component

indicating the motion component on the time axis of the video signal, at each time when said video input signal advances by one field; and

calculating means of calculating an M/N ratio which is the ratio of said M component to said N component.

6.   (Original) A repeat field detecting apparatus according to claim 1, wherein said RF determination reliability calculating means returns a value indicating the reliability of said first RF determining means corresponding to the output value of said M/N ratio calculating means, on the basis of previously-obtained information indicating the relation between the reliability of said first RF determining means and the output of said M/N ratio calculating means and on the basis of the output provided from said M/N ratio calculating means.

7.   (Original) A repeat field detecting apparatus according to claim 1, wherein said first RF determining means comprises:

period position identifying means of being initialized by an initialization input, then being incremented by one at each time when said discrepancy pixel number is received in association with the elapse of one field, and then returning to the initial value after the elapse of five fields, so as to output a period position;

initial period checking means of outputting whether said period position identifying means has advanced by one or more periods or not;

first through fifth accumulated averaging means of calculating the average of said discrepancy pixel numbers when said period position identifying means indicates the n-th field (n=1 through 5), so that the average is stored into the n-th accumulated averaging means; and

determining means of determining the field as a repeat field when the output value selected from the output values of said first through fifth accumulated averaging means in correspondence to the output value of said period position identifying means is the minimum one among the output values of said first through fifth accumulated averaging means, and otherwise determining the field as an ordinary field.

8.   (Original) A repeat field detecting apparatus according to claim 7, comprising

scene change detecting means of determining the presence or absence of a scene change in said video input signal on the basis of said discrepancy pixel number, wherein

said initialization input is an input provided from said scene change detecting means when the output of said scene change detecting means indicates a scene change, and wherein

said n-th accumulated averaging means stores said discrepancy pixel number when said initial period checking means is in the initial state and when said period position identifying means indicates the n-th field; and stores the average between said discrepancy pixel number and the value stored in said n-th accumulated averaging means when said initial period checking means is in a state other than the initial state and when said period position identifying means indicates the n-th field, and further resets said period position identifying means and said initial period checking means when the output of said scene change detecting means indicates a scene change.

9.   (New) A repeat field detecting apparatus which is used in a video progressive conversion reproducing apparatus of converting a video input signal of interlace scheme into a video signal of progressive scheme and which detects whether said video input signal is a repeat field where the same video image is outputted repeatedly or an ordinary field which is other than said repeat field, said repeat field detecting apparatus comprising:

long term M/N ratio calculating means of obtaining an N component which is the number of discrepancy pixels between said repeat fields and an M component which is the number of discrepancy pixels between at least a pair of fields which are other than said repeat fields and have said predetermined distance from each other, on the basis of a discrepancy pixel number which is the number of the pixels having discrepancy between the pixel information of a field of said video input signal and the pixel information of a field of said video input signal having a predetermined distance from the former-mentioned field of the video input signal and on the basis of information of a scene change, and then calculating a long term M/N ratio which is the ratio of said M component to said N component on the time axis of said video input signal ranging from the scene change to the present;

M/N ratio adaptive scene change detecting means of determining the presence or absence of a scene change in said video input signal on the basis of said discrepancy pixel number and the output of said long term M/N ratio calculating means;

M/N ratio adaptive composite RF determining means of detecting a repeat field on the basis of said discrepancy pixel number and the output of said M/N ratio adaptive scene change detecting means;

RF determination reliability calculating means of outputting the reliability of said M/N ratio adaptive composite RF determining means on the basis of the output of said long term M/N ratio calculating means; and

M/N ratio adaptive repeat field confirming means of confirming the output of said first RF determining means as the determination result on the basis of said reliability outputted from said RF determination reliability calculating means; and wherein

said information of a scene change is the determination result of said M/N ratio adaptive scene change detecting means.

10.   (New) A repeat field detecting apparatus according to claim 9, wherein

said predetermined distance is a distance having one field therebetween, and wherein

said at least a pair of fields are one or more pairs of fields among four pairs of fields which adjoin the arbitrary pair of fields which measure a M/N ratio.

11.   (New) A repeat field detecting apparatus according to claim 9, wherein

said at least a pair is two pairs or more, and wherein

said M component is the average between the discrepancy pixel numbers of said two pairs or more of fields.

12.   (New) A repeat field detecting apparatus according to claim 9, wherein said M/N ratio adaptive composite RF determining means comprises:

a first RF determining means according to claim 7;

a second RF determining means of comparing said discrepancy pixel number with a second RF determination threshold value which is a predetermined value, then detecting that the field is a repeat field if said discrepancy pixel number is smaller than said second RF determination threshold value, and detecting that the field is an ordinary field if said discrepancy pixel number is greater than said second RF determination threshold value;

discrepancy pixel storing means of storing said discrepancy pixel number and then outputting said discrepancy pixel number with a delay of one field;

a third RF determining means of comparing the output of said discrepancy pixel storing means with said discrepancy pixel number, then detecting that the field is a repeat field if said discrepancy pixel number is smaller than or equal to the output of said discrepancy pixel storing means, and detecting that the field is an ordinary field if said discrepancy pixel number is greater than the output of said discrepancy pixel storing means;

M/N ratio calculating means of calculating an M/N ratio which is the ratio of the motion component to the noise component on the time axis of said video input signal, from said discrepancy pixel number;

a fourth RF determining means of selecting a threshold value obtained in advance for the purpose of repeat field detection in correspondence to an M/N ratio based on the output of said M/N ratio calculating means, then comparing said discrepancy pixel number with a fourth RF determination threshold value generated by adding the inputted N component to said selected threshold value, then detecting that the field is a repeat field if said discrepancy pixel number is smaller than said fourth RF determination threshold value, and detecting that the field is an ordinary field if said discrepancy pixel number is greater than said fourth RF determination threshold value;

m-th M/N ratio adaptive RF determination value means of returning the reliability of said m-th (m=1 through 4) RF determining means on the basis of the output of said M/N ratio calculating means; and

adding means of adding the output of said m-th M/N ratio adaptive RF determination value means, then comparing this result with an M/N ratio adaptive composite RF determination threshold value which is a predetermined value, then determining the field as a repeat field when said result is greater than said threshold value, and determining the field as an ordinary field when said result is smaller than said threshold value.

13.   (New) A repeat field detecting apparatus according to claim 12, wherein said m-th (m=1 through 4) M/N ratio adaptive RF determination value means outputs a value which is a predetermined and recorded value corresponding to the output of the M/N ratio calculating means and indicating the reliability of the m-th RF determining means, and which is positive for a repeat field and is negative for an ordinary field, and further the absolute value of which indicates the reliability, wherein a large value indicates high reliability, while a small value indicates low reliability.

14.   (New) A repeat field detecting apparatus according to claim 9, wherein said long term M/N ratio calculating means comprises:

period position identifying means of being initialized by an initialization input, then being incremented by one at each time when said discrepancy pixel number is received in association with the elapse of one field, and then returning to the initial value after the elapse of n fields (n=1 through 5), so as to output a period position;

initial period checking means of outputting whether said period position identifying means has advanced by one or more periods or not;

first through fifth accumulated averaging means of calculating the average of said discrepancy pixel numbers when said period position identifying means indicates the n-th field, so that the average is stored into the n-th accumulated averaging means;

long term N component means of setting the minimum value among the output values of said first through n-th accumulated averaging means as a long term N component indicating the amount of the noise component on the time axis of the input video signal, on the basis of said n-th accumulated averaging means at each time when said video input signal advances by one field;

long term M component means of subtracting the value of said long term N component means from the sum of all the output values of said first through n-th accumulated averaging means, then dividing the value by $n-1$, and then setting this result as a long term M component indicating the motion component on the time axis of the video signal, at each time when said video input signal advances by one field; and

calculating means of calculating a long term M/N ratio which is the ratio of said long term M component to said long term N component.

15.   (New) A repeat field detecting apparatus according to claim 14, wherein said M/N ratio adaptive scene change detecting means compares the absolute value of the difference between said discrepancy pixel number and said long term M component with said M/N-ratio dependent threshold value, then determines the scene as a continuous scene when said absolute value is smaller than the threshold value, and determines the scene as a scene change when said absolute value is greater than or equal to the threshold value.

16.   (New) A video progressive conversion reproducing apparatus comprising:

a repeat field detecting apparatus according to claim 8;

motion picture material continuation period identifying means of being incremented by one when said video input signal is motion picture material, and being cleared into zero for video material, and further being cleared into zero also when said scene change detecting means or said M/N ratio adaptive scene change detecting means outputs a determination indicating a scene change, so as to count the periods where the motion picture determination is in continuation;

motion picture composition filter selection threshold value calculating means of calculating a threshold value varying depending on the output of said M/N ratio calculating means; and

M/N ratio adaptive progressive conversion controlling means of comparing the output of said motion picture composition filter selection threshold value calculating means with said motion picture material continuation period, then performing an output such as to set a filter appropriate for motion picture material if the former-mentioned output is greater than said motion picture composition filter selection threshold, and performing an output such as to set a filter appropriate for a still image if said output is smaller than said motion picture composition filter selection threshold and if said material determining means determines the field as a still image, and otherwise performing an output such as to set a filter appropriate for video material.

17. (New) A video progressive conversion reproducing apparatus comprising:

a repeat field detecting apparatus according to claim 15;

motion picture material continuation period identifying means of being incremented by one when said video input signal is motion picture material, and being cleared into zero for video material, and further being cleared into zero also when said scene change detecting means or said M/N ratio adaptive scene change detecting means outputs a determination indicating a scene change, so as to count the periods where the motion picture determination is in continuation;

motion picture composition filter selection threshold value calculating means of calculating a threshold value varying depending on the output of said long term M/N ratio calculating means; and

M/N ratio adaptive progressive conversion controlling means of comparing the output of said motion picture composition filter selection threshold value calculating means with said motion picture material continuation period, then performing an output such as to set a filter appropriate for motion picture material if the former-mentioned output is greater than said motion picture composition filter selection threshold, and performing an output such as to set a filter appropriate for a still image if said output is smaller than said motion picture composition

filter selection threshold and if said material determining means determines the field as a still image, and otherwise performing an output such as to set a filter appropriate for video material.

18.   (New) A video progressive conversion reproducing apparatus according to claim 16 or 17, comprising:

filter change history means of recording as a history the information whether the filter setting has been changed in said M/N ratio adaptive progressive conversion controlling means or not;

filter change frequency detecting means of being incremented by one when the filter setting is changed in said M/N ratio adaptive progressive conversion controlling means, and being decremented by one when the filter change information delayed by d fields in said filter change history means indicates a filter change, so as to detect the filter change frequency in the past d fields; and

irregular pattern countermeasure controlling means of comparing with a filter variation allowable limit frequency indicating the allowable limit for filter v ariation, and then, if said filter change frequency is greater than the allowable limit, causing said filter selecting means to select video filter means and changing said d value and said filter variation allowable limit so as to adjust the sensitivity.

19.   (New) A repeat field detecting method which is used in a video progressive conversion reproducing apparatus of converting a video input signal of interlace scheme into a video signal of progressive scheme and which detects whether said video input si gnal is a repeat field where the same video image is outputted repeatedly or an ordinary field which is other than said repeat field, said repeat field detecting method comprising:

an RF determining step of identifying a repeat field having a predetermined distance from said video input signal, on the basis of a discrepancy pixel number which is the number of the pixels having discrepancy between the pixel information of a field of said video input signal and the pixel information of a field of said video input signal having a predetermined distance from the former-mentioned field of the video input signal;

an M/N ratio calculating step of obtaining an N component which is the number of discrepancy pixels between said repeat fields and an M component which is the number of discrepancy pixels between at least a pair of fields which are other than said repeat fields and have said predetermined distance from each other, and then calculating an M/N ratio which is the ratio of said M component to said N component;

an RF determination reliability calculating step of outputting the reliability of the determination result of said first RF determining step on the basis of the output of said M/N ratio calculating step; and

an M/N ratio adaptive repeat field confirming step of confirming the output of said first RF determining step as the determination result on the basis of said reliability outputted from said RF determination reliability calculating step.

20.   (New) A repeat field detecting method which is used in a video progressive conversion reproducing apparatus of converting a video input signal of interlace scheme into a video signal of progressive scheme and which detects whether said video input signal is a repeat field where the same video image is outputted repeatedly or an ordinary field which is other than said repeat field, said repeat field detecting method comprising:

a long term M/N ratio calculating step of obtaining an N component which is the number of discrepancy pixels between said repeat fields and an M component which is the number of discrepancy pixels between at least a pair of fields which are other than said repeat fields and have said predetermined distance from each other, on the basis of a discrepancy pixel number which is the number of the pixels having discrepancy between the pixel information of a field of said video input signal and the pixel information of a field of said video input signal having a predetermined distance from the former-mentioned field of the video input signal and on the basis of information of a scene change, and then calculating a long term M/N ratio which is the ratio of said M component to said N component on the time axis of said video input signal ranging from the scene change to the present;

an M/N ratio adaptive scene change detecting step of determining the presence or absence of a scene change in said video input signal on the basis of said discrepancy pixel number and the output of said long term M/N ratio calculating step;

an M/N ratio adaptive composite RF determining step of detecting a repeat field on the basis of said discrepancy pixel number and the output of said M/N ratio adaptive scene change detecting step;

an RF determination reliability calculating step of outputting the reliability of said M/ N ratio adaptive composite RF determining step on the basis of the output of said long term M/N ratio calculating step; and

an M/N ratio adaptive repeat field confirming step of confirming the output of said first RF determining step as the determination result on the basis of said reliability outputted from said RF determination reliability calculating step; and wherein

said information of a scene change is the determination result of said M/N ratio adaptive scene change detecting step.

21.   (New) A program of causing a computer to serve as:

RF determining means of identifying a repeat field having a predetermined distance from said video input signal, on the basis of a discrepancy pixel number which is the number of the pixels having discrepancy between the pixel information of a field of said video input signal and the pixel information of a field of said video input signal having a predetermined distance from the former-mentioned field of the video input signal;

M/N ratio calculating means of obtaining an N component which is the number of discrepancy pixels between said repeat fields and an M component which is the number of discrepancy pixels between at least a pair of fields which are other than said repeat fields and have said predetermined distance from each other, and then calculating an M/N ratio which is the ratio of said M component to said N component;

RF determination reliability calculating means of outputting the reliability of the determination result of said first RF determining means on the basis of the output of said M/N ratio calculating means; and

M/N ratio adaptive repeat field confirming means of confirming the output of said first RF determining means as the determination result on the basis of said reliability outputted from said RF determination reliability calculating means; in a repeat field detecting apparatus according to claim 1.

22.   (New) A program of causing a computer to serve as:

long term M/N ratio calculating means of obtaining an N component which is the number of discrepancy pixels between said repeat fields and an M component which is the number of discrepancy pixels between at least a pair of fields which are other than said repeat fields and have said predetermined distance from each other, on the basis of a discrepancy pixel number which is the number of the pixels having discrepancy between the pixel information of a field of said video input signal and the pixel information of a field of said video input signal having a predetermined distance from the former-mentioned field of the video input signal and on the basis of information of a scene change, and then calculating a long term M/N ratio which is the ratio of said M component to said N component on the time axis of said video input signal ranging from the scene change to the present;

M/N ratio adaptive scene change detecting means of determining the presence or · absence of a scene change in said video input signal on the basis of said discrepancy pixel number and the output of said long term M/N ratio calculating means;

M/N ratio adaptive composite RF determining means of detecting a repeat field on the basis of said discrepancy pixel number and the output of said M/N ratio adaptive scene change detecting means;

RF determination reliability calculating means of outputting the reliability of said M/N ratio adaptive composite RF determining means on the basis of the output of said long term M/N ratio calculating means; and

M/N ratio adaptive repeat field confirming means of confirming the output of said first RF determining means as the determination result on the basis of said reliability outputted from said RF determination reliability calculating means; in a repeat field detecting apparatus according to claim 9.

23.   (New) A computer-processable recording medium carrying a program according to claims 21 or 22.